

ENGINE TEST PROGRAM

18 May 1956

1. Following is a summary of the engine test program which has the approval and concurrence of the 4070th Support Wing (SAC), Detachment B, Airframe Representative, Engine Representative and the Base Commander Watertown Strip.
2. References:
 - A. Hqs. TWX 2176
 - B. Hqs. TWX 2109
 - C. Hqs. TWX 2038
 - D. Chart - Engine Test Program (attached).
3. Conditions: Following are conditions upon which program was projected.
 - a. That the 50 hour hot section inspection period for the P-31 engine would be extended to 75 for engine #747, see chart key (3).
 - b. That the hot section inspection period for the P-31 engines installed in aircraft numbers 3 and 4 (see chart) will be extended to 100 hours pending inspection of 50 hour engines #915 and 463 now at PAC.
 - c. Average weekly flying hours as shown, see chart. It is expected that these averages will be exceeded; nonetheless those shown are reasonable of attainment.
 - d. That the P-31 engine to be operated for 100 hours on the turbine blades, see chart key (5). (will be installed in aircraft #1 immediately upon delivery from PAC). The turbine blades to be installed in engine #915 key (5) are the ones having 50 hours time which were removed from engine #464, the first engine to reach 50 hours.
 - e. The engines equipped with forged turbine blades will be operated for 100 hours hot time (i.e., 100 hours at 660° EGT for the F-37 and 100 hours at 610° EGT for the P-31 engine). In either case the total flying hours before inspection will be approximately 125 hours since all flying is not at the maximum EGT.
 - f. That P-37 engines #576 and 739 have the new #3 bearing seal which is expected to reduce the oil consumption and the amount of oil in the cockpit and equipment bay.
4. Summary:
 - a. This program on the P-31 at Watertown will accumulate 260 hours as of 19 May, 300 hours by 23 May and 425 hours in the period 23 June to 1 July.
 - b. The P-31 engine to accumulate 100 hours on the turbine blades will be some 3 to 4 weeks later than originally anticipated. Considering all the facts and the delay in the expected delivery of engine #915 with the 50 hour blades, no other course of action is open. Every effort will be made to accelerate the accumulation of time on engine #915.

ENGINE TEST PROGRAM.

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c. If authorization is given to extend the time on the P-31 engines installed in aircraft numbers 3 and 4 we will have three engines by late June having a total of 100 hours.

APPROVED:



Colonel USAF
Base Commander



/ Lt. Col. USAF

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cc: Engine Company
Airplane Company
4070th
Det. B

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15 March 1956

MEMORANDUM FOR THE RECORD

SUBJECT : Headquarters 4070th Support Wing letter dated 9 January 1956
re "Aircraft and Equipment Problem Areas - Project AQUATONE

1. This memorandum is a Project Headquarters reply to subject letter and indicates action taken for the correction of deficiencies listed. This memorandum was purposely delayed pending expected developments during the past two months which eliminated most of the problems listed. For continuity, reference is made to each paragraph by its respective number.

Para. 1. Although pilots of the SAC Wing had flown the aircraft a number of sorties, they had not received sufficient time in the aircraft to make thorough and complete comments. Some of the requests have been withdrawn since the issuance of their report. Furthermore, most of the participants were not familiar with the concept and history of the development of the vehicle, and accordingly pursued a more routine and standard USAF approach in making their comments. In general, however, the letter is constructive and has been used as a guide in following progress of corrections made in the various areas.

Para. 2. Personal and Survival Equipment.

a. Seatpack. In general, Project Headquarters and the USAF have been fully aware of all the discrepancies raised in this paragraph and are in agreement with the comments. Before the subject letter was received considerable action had been taken to correct aeromedical deficiencies; namely, quality control was a main subject of concern and was well underway toward being corrected by the Air Force. Recent reports indicate that this situation has improved and is well in hand. The radio wiring system and interphone problems have been improved and no major deficiencies noted on recent flights. The faceplate heating wires and connections have also been modified and improved. The ultimate solution to the faceplate heating wire problem is the development of an entirely new helmet which eliminates this requirement entirely.

b. Survival Equipment. The recommendation made under survival equipment is being fulfilled by the Air Force. The present concept includes the development of two survival kits. One will be an Air Force version and the other will be a kit provided each pilot allowing him to develop and install individual items to his liking. Size and space requirements must be standardized.

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c. Equipment Availability. This recommendation is concurred in and in the interim period the Air Force has procured considerable quantities of equipment and spare parts, for Detachments A, B and C in addition to the equipment being procured for Air Force programs.

In summary, the entire aeromedical equipment program has been changed to include certain items of equipment not available at the time the letter was written. The Air Force has assured us that before Detachment A deploys they will have an entirely new standardized aeromedical package to include suits, vests, shoes, new helmets, improved electrical wiring and disconnects, and survival equipment. It is intended that this will be the final configuration and that few changes will be made in the future.

Para. 3. Cockpit

a. The problem of rearranging instruments in an aircraft is a difficult one and is subject to the desires of every individual. It must be emphasized that at the time this report was written many items on the instrument panel and equipment controls were not finalized and accordingly it was intended that a final cockpit instrument location mockup would be required before standardization could be achieved. Such an instrument inspection mockup was held at Watertown last month with SAC, Lockheed and Project Headquarters R & D representatives attending. Several changes were made in instrument locations at this meeting and it is understood that there is unanimous agreement with the arrangements made at that time. In the future it will be necessary to add occasional controls and instruments.

b. Radio Compass. The radio compass operation has been improved by moving the loop antenna to the landing gear doors of the aircraft. This has corrected the sensing problem for high altitude flying with the gear up. However, there is still a problem of proper sensing with the gear down. This problem will be explored further in order to provide sensitive and accurate sensing under both gear-up and gear-down conditions since instrument approaches will require reliable radio compass performance under all aircraft configurations.

c. Cockpit Placarding. Instruments will be placarded in accordance with the recommendation.

d. Periscope Viewfinder. This is a continuing project; however, the latest development in this area includes Polaroid lenses which eliminate glare and reflection. It may be necessary to include a shield in addition to the Polaroid glass.

e. Altimeter and Rate-of-Climb Indicators. Concur with recommendation that more sensitive pressure indicating instruments are required and that USAF take action.

f. Plotting Boards and other Cockpit Equipment. The latest recommendations from the pilots indicate that no such items of equipment are necessary since they are bulky and difficult to manage in cramped

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quarters. This will be a continuing project; however, it is anticipated that each pilot will develop his own method of handling maps and plotting requirements. As new systems are included in the aircraft it may be necessary to add certain conveniences for the pilot in this respect. At this time no specific project exists for providing standardized equipment to cope with this request.

g. Ejection Seat. The requirement for an ejection seat has been verbally withdrawn by SAC. This is an example of indoctrination in the original mission concept. The ejection seat was seriously considered in the beginning and was deleted not only because of weight but because of the high risk concept and the use of [] for the operational phase. In this respect the Air Force has concurred in deleting the ejection seat in their aircraft. No action will be taken to include an ejection seat in the vehicle.

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Para. 4. Aircraft General

a. Fuel Pump. Fuel pump difficulties have been corrected through the use of a variable speed hydraulically driven fuel boost pump. During the last few months there have been no failures or deficiencies in this area. Continued effort will be made to determine life expectancy of fuel pumps in order to remove them well in advance of any life expectancy failure.

b. Night Lighting. Landing lights will be installed on all aircraft. To date several flights have been made by various pilots and no deficiencies reported. It appears that the existing installation is satisfactory.

c. Uneven Fuel Feeding. Uneven fuel feeding has been corrected by placing a vent in the fuel line connecting the two wing fuel cells. It was determined that the uneven feeding was caused by syphoning of fuel from one wing to the other. With the vent installed, syphoning is prevented thus eliminating uneven distribution of fuel. Since this installation has proved reliable there appears to be no reason for including a transfer pump to achieve the same result.

d. Auto Pilot. At the time the report was submitted the auto pilot had just been installed in the aircraft. Since that date considerable auto pilot testing has been successfully accomplished. In this area, however, there is room for constant improvement and Project Headquarters will continue to follow new auto pilot developments. One item required to improve the auto pilot's functioning is a new Mach sensing device which was requested by Lockheed. This device is in short supply but should be available in the future through USAF sources.

e. Camera Equipment. Although some improvement has been made in the reliability of camera operations, it is not yet completely satisfactory. One of the main deficiencies in this respect is the lack of training of

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camera maintenance personnel. However, as time progresses these people should become more proficient in their duties thus improving reliability.

f. Allowable Engine Life. Engine life has been extended to 100 hours and the engine manufacturer anticipates extending engine life considerably higher than this figure. As more time is obtained at altitude engine overhaul life will be extended.

Para. 5. New Development Items

a. Pulsating Seat. The pulsating seat has always been a controversial item but was considered at the outset of the program. There was no conclusive data which indicated that a pulsating seat would relieve pilot fatigue. Therefore no action will be taken to introduce this item in the aircraft.

b. Navigational Equipment

(1) A Baird manually controlled sextant is installed in the number 8 aircraft. It has not been tested or proven at this time. However, Project Headquarters plans to incorporate a sextant in each aircraft provided that it proves useful after further tests. Informal reports from the pilots flying the aircraft on long range navigation missions indicate that they have no desire to use a sextant since navigation through dead reckoning has been precise. In any event we intend to include a sextant as a navigational aid.

(2) Electronic Navigation Aid. The R-W system 2N is a complicated system and will not be available for use in the aircraft until mid-1956. Project Headquarters intends to pursue this system and if it proves satisfactory it will be installed in each aircraft. The first few aircraft will include the communications component of system 2 with the navigational component added at a later date.

(3) Training of pilots in both sextant and system 2 is complicated and probably will not be accomplished prior to the deployment of Detachment A. However, as these new equipments are approved for use, pilots will receive additional training on each component overseas.

(4) At this time it is impossible to determine the reliability of these equipments. It will be necessary to continue the training of all pilots on each new item of equipment that becomes available after deployment.

2. In general, all of the deficiencies noted in the subject report were under consideration by Project Headquarters. With few exceptions, all deficiencies should be eliminated in the immediate future.

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Colonel, USAF
Deputy Project Director

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DISPATCH NO. [] 0103

Page 1 of 2

24 March 1956

TO : []
FROM : []
SUBJECT: Modification of []

1. Reference is made to the following correspondence:

a. Headquarters letter 1617/G (Revised) dated 21 February 1956 subject, "Organization and Lines of Command at []"

b. Headquarters 4070th Support Wing [] letter dated 9 January 1956, "Aircraft and Equipment Problem Areas, Project 'Aquatone'."

2. Pursuant to authority granted in referred correspondence above, [] has been given approval to make Modification to the [] as set forth on attached Modification List dated 21 February 1956 and revised 11 March 1956. Attached as enclosure 2 is diagram Instrument Panel indicating up to date Cockpit arrangement.

3. All modifications will be subject to review and coordination of Commander [] prior to incorporation in []

4. The following major changes to the cockpit arrangement and instrumentation have been agreed to by [], Commander [] and the Commander 4070th Support Wing KWPUSH in a joint meeting held at [] on 21 February 1956.

a. Auto Pilot, Modification #104/117: Remove existing mounting provisions and controls and relocate in the outboard position of the present ARC-34 radio control panel. This will require that the right side panel where the cabin altimeter is located be moved forward approximately 1½ inches.

b. ARC-34 Radio, Modification #104: Remove cockpit control from present position, right side, to the existing oxygen regulator panel position, left side.

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c. Oxygen Regulator Panel, Modification #115: Remove the panel. Install oxygen pressure gage on panel forward of throttle quadrant, mount on-off regulator on left side outboard of the removable panel, and mount pilots oxygen disconnect on left side panel adjacent to pilots seat.

d. Oil Temperature Indicator, Modification #117: Delete oil temperature instrument.

e. Accelerometer and Trim Indicator Auto Pilot, Modification #107/117: Remove accelerometer from its present position to the equipment bay and install trim indicator in space vacated by accelerometer.

f. Elapsed Trim Clock, Modification #107: Add an elapsed time clock in the present accelerometer location.

g. Avien FGT Gage, Modification #114: Remove present exhaust gas temperature instrument and install Avien type instrument complete.

h. Throttle Control, Study: KWBAAL will study different throttle configurations to determine if another control can be devised which does not project into the cockpit area as much as the existing control. *o/p*

5. Above listed modifications satisfy those requirements cited in referred correspondence b. above.

cc.

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*Cy1 - RMB
2 - D/Pro Dir
3 - Contracting O.*

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*Copy #1***LOCKHEED AIRCRAFT CORPORATION**

CALIFORNIA DIVISION

REPORT

AIRFRAME VS. EQUIPMENT SUMMARY AS OF**12-8-55**

This summary is very brief and only highlights the overall problems affecting the compatibility of the airframe and the equipment.

The tactical combinations which may be achieved by use of the various equipments is indicated in Fig. 1 where, for simplicity, only five representative types have been considered. Notice that there is a basic difference occurring with aircraft 349 which permits the use of Systems III and IV, and APQ56. These equipments cannot be installed on aircraft 341 thru 348.

The weight of tactical equipment provided for these aircraft has been increasing gradually over the original design objective of 450 pounds.

The manner in which this added weight of equipment will affect the overall mission performance is indicated in Fig. 2. This graph is calculated and subject to flight test revision, but the orders of magnitude are correct and these effects on the basic mission must be considered.

An overall delivery schedule of aircraft and tactical equipment is shown on Fig. 3 for planning purposes. For any month of the year the available number of aircraft and any particular equipment can be obtained. As can be seen, not enough of some equipment will be available for early operations.

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FIGURE 1

TACTICAL COMBINATIONS

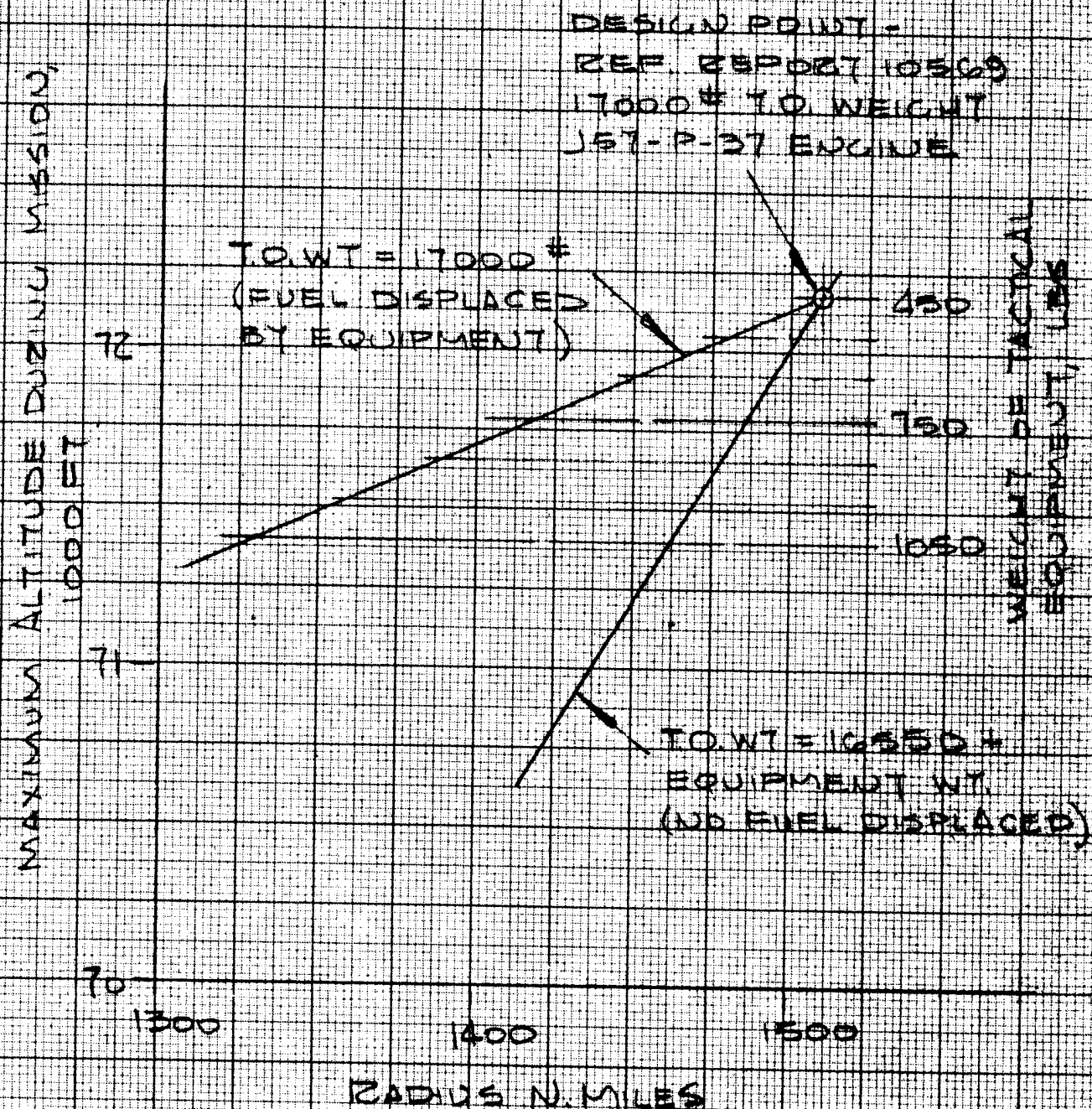
EQUIPMENT	MAX			AVAIL. DATE	MATING A/C	AIRCRAFT TYPES				
	WT. LBS	POWER 28VDC AMPS	REQ 400N 3Φ VA			BASIC PHOTO	PHOTO I & II RCVR'S	SYSTEM II	APQ 56	APQ 56 + PHOTO
DRIFT SIGHT	42	4		9/15/55	AIRCRAFT 341 THRU 348	X	X	X		
CHARTING CAMERA	49	4		9/15/55		X	X	X	X	X
11 CAMERAS	350	48		10/17/55						(143*) X
12 CAMERAS	379	26		9/15/55		X	X			
13 CAMERA	377	48		1/2/56						
14 CAMERA	385	48		6/1/56	AIRCRAFT 349 THRU 360					
5 & X RCVR'S I	17	4		9/15/56		X	X			
COMM. & NAVIG. II	60	21	350 (+600 PULSE)	3/1/56		X	X	X	X	X
HF RCVR III	40		280	3/15/56			X			
ADAE RCVR'S IV	400		2000	9/1/56				X		
PQ 56	520	5	2508	4/1/56					X	X
EQUIPMENT TOTAL WEIGHT, LBS						547	587	551	629	772
MAXIMUM POWER REQ'S						59	59	29	30	78
						350	630	2350	2858	2858
						950	1230	2950	3458	3458

55, REVISED 12/8/55

PREPARED BY _____
 DATE 12/10/55
 CHECKED BY _____

LOCKHEED AIRCRAFT CORPORATION
 CALIFORNIA DIVISION

PAGE **FIGURE 2**
 MODEL _____
 REPORT NO. _____



EFFECT OF INCREASED WEIGHT OF TACTICAL
 EQUIPMENT ON BASIC MISSION RADIUS &
 ALTITUDE.

(ABOVE DATA SUBJECT TO FLIGHT TEST EVALUATION)

EQUIPMENT AVAILABILITY

	ACTUAL DELIVERY											12/12	PROJECTED DELIVERY										
	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC					
AIRCRAFT	1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
DEIFT SIGHT			P	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
CHARTING CAMERA			P	1																			
A1 CAMERAS					1	2	3	4	5	6	7	8	9										
CLASS	1	2	3-4	5-6	7-8	9-10	11																
HATCHES				1		2	3	4	5	6	7	8	9	10	11	12							
A2 CAMERAS			1			2	3	4	5	6	7	8	9										
CLASS	1	2	3-4	5-6	7-8	9-10	11																
HATCHES			1				2	3	4	5	6	7	8	9		10	11	12					
B CAMERA							1	2	3	4	5	6											
CLASS		1		2	3	4	5	6	7	8	9	10	11	12									
HATCHES					1				2	3	4	5											
C CAMERA													1	2	3	4	5						
CLASS										1	2	3	4	5	6	7	8	9	10				
HATCHES												1	2	3	4	5	6	7	8	9	10		
SYSTEM I	1	2	3	4	5	6	7	8	9	10	11	12											
SYSTEM II										ETC?													
SYSTEM III										1	2	3	4	5	6								
SYSTEM IV																			ETC?				
HATCHES																			ETC?				
APQ 56																							
BADONES								1		2	3	4	5	6									

AIRCRAFT 5 THRU 20

AIRCRAFT 1 THRU 4

AIRCRAFT 1 THRU 4
AFTER MODIFICATION

LOCKHEED AIRCRAFT CORPORATION
CALIFORNIA DIVISION**REPORT**

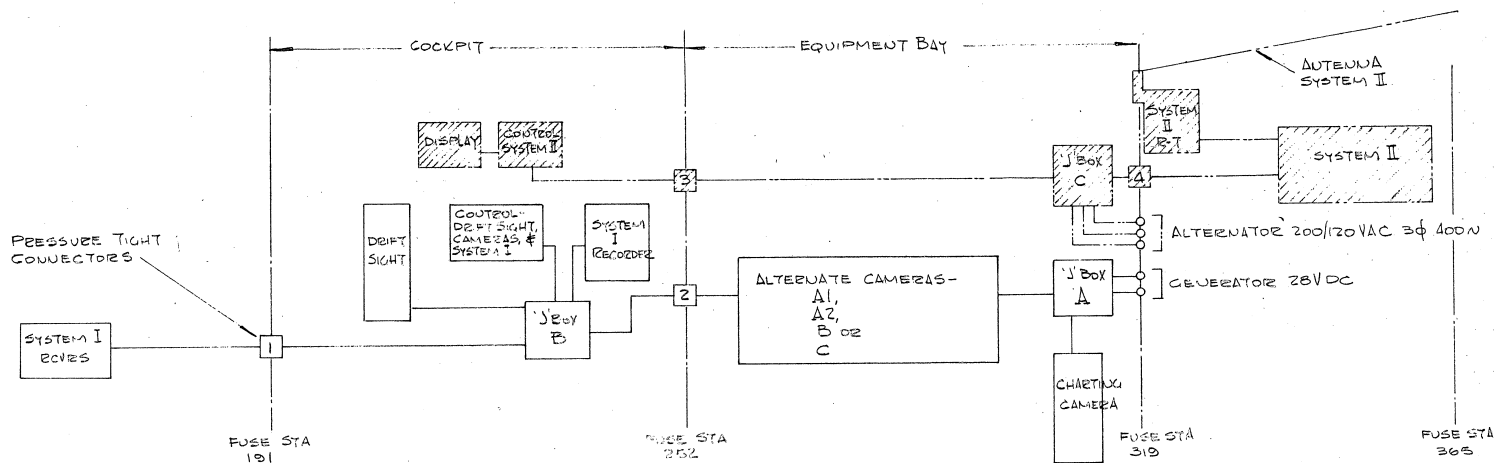
The systems of equipment that are being incorporated into the aircraft are shown on Figs. 4 thru 7. Up to the present time, these systems have been arranged so that a minimum weight penalty is exacted by not having unused components or wiring in the aircraft at any time. For instance, the only permanent wiring for tactical equipment that stays in the aircraft at all times is that in the cockpit area. All other wiring harnesses and "J" boxes are removed with the particular equipment. The fabrication of the removable wiring harnesses and "J" boxes has been delegated to the equipment supplier for ease of coordination. The systems that are provided for in aircraft 341 thru 348 are shown in Fig. 4; Figs. 5, 6 and 7 apply only to aircraft 349 and up.

The following comments indicate the current state of mating equipments and aircraft.

1. Drift Sight

- A. Prototype installed in A/C 342. Production units 1, 2, and 3 installed in A/C 343, 344 and 345.
- B. The hand controls have been stiff, although the units installed in A/C 344 and 345 appear satisfactory. Defective hand controls in A/C 342 and 343 will be repaired or replaced by 1-10-55.
- C. Flying experience indicates that we placed the pilot's image too far back and too low for comfortable viewing. This has been corrected in the drift sight head provided for A/C 344 and will be retrofitted by 12-20-55.
- D. A light shield is mocked up on A/C 342 and 343. Will be provided as standard equipment shortly.

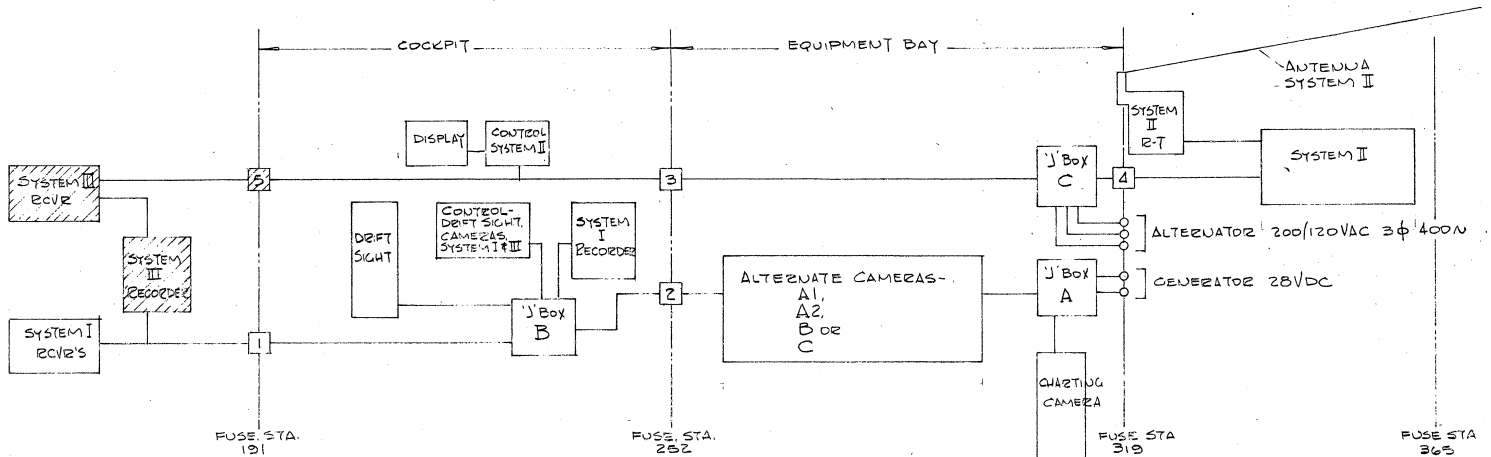
FIGURE 4




NOTE -
 AIRCRAFT 341 THRU 348 WILL ACCOMMODATE THIS ARRANGEMENT AS FOLLOWS -
 1. THE PRESENT AIRCRAFT 341 THRU 348 PROVIDE FOR THE CAMERA, DEPT SIGHT & SYSTEM I INSTALLATIONS.
 2. THESE AIRCRAFT REQUIRE THE MODIFICATIONS SHOWN AS [Hatched Box] TO INSTALL SYSTEM II.
 3. AIRCRAFT 345 & UP WILL HAVE THE 3φ ALTERNATOR INSTALLED. AIRCRAFT 341 THRU 344 WILL BE MODIFIED AS REQUIRED.

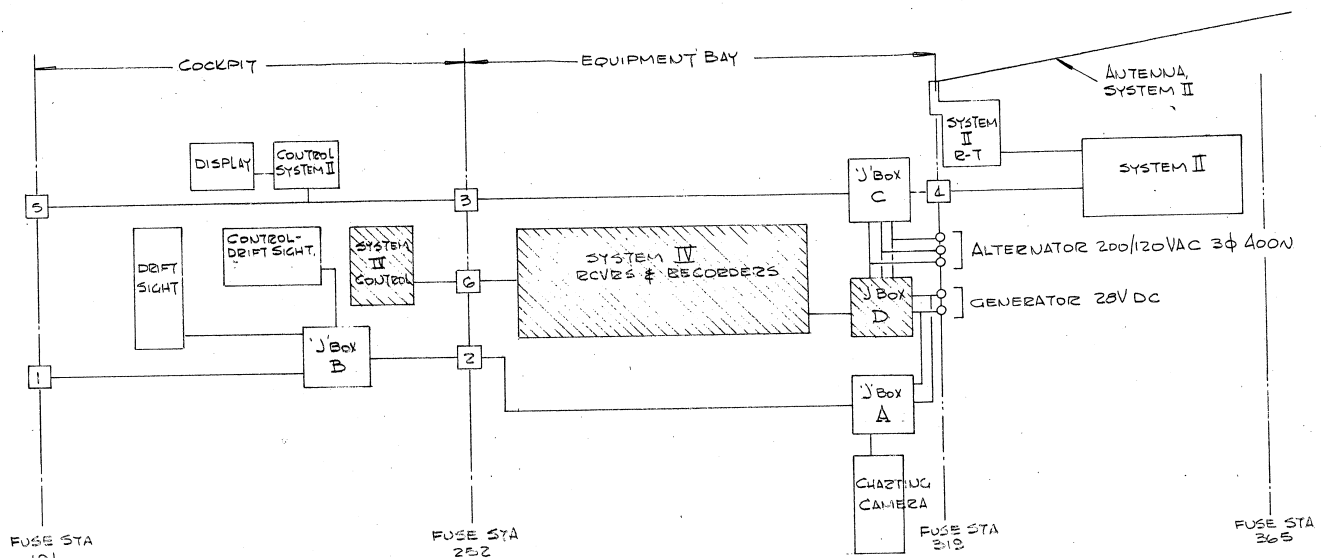
BASIC PHOTO ARRANGEMENT

FIGURE 5



NOTE -
 AIRCRAFT 349 THRU 360 WILL ACCOMMODATE THIS
 ARRANGEMENT.
 1. THESE AIRCRAFT WILL HAVE ALL BASIC CHANGES INCORP-
 ORATED FOR INSTALLING THE ABOVE OR OTHER PRESENTLY
 PLANNED EQUIPMENT.
 2. THE EQUIPMENT ADDITIONS ARE INDICATED AS .

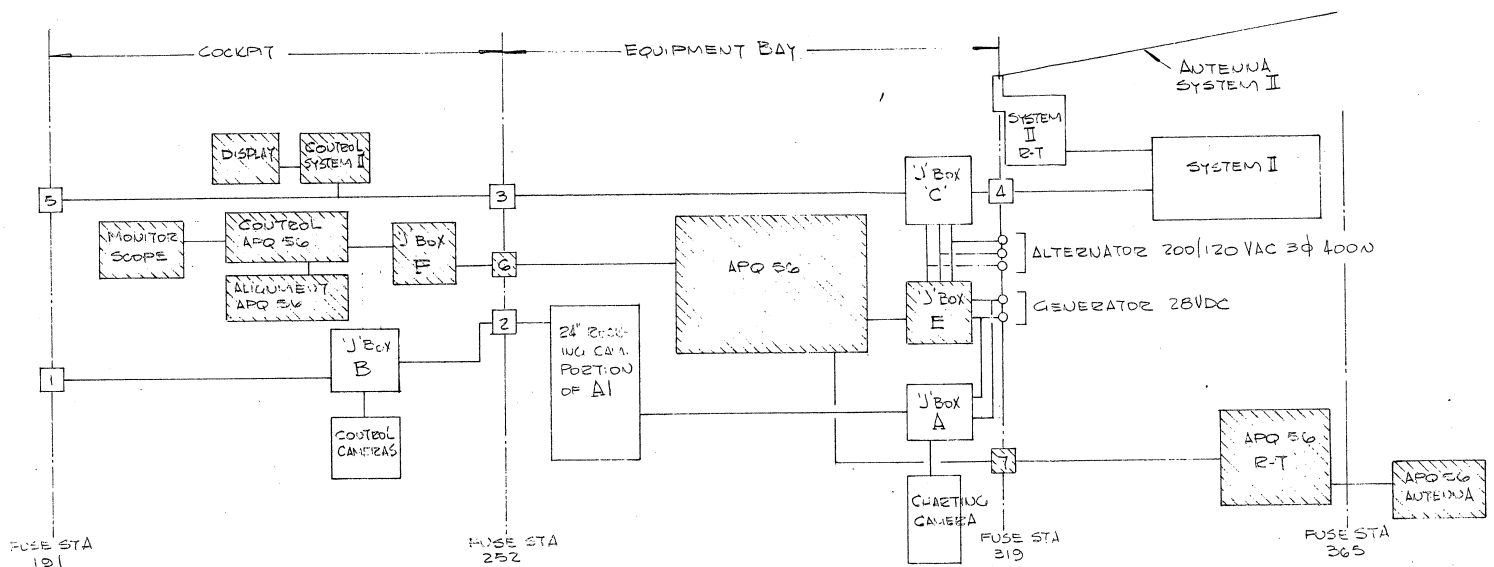
BASIC PHOTO + RADAR & VHF
 RCVR ARRANGEMENT.




NOTE -
AIRCRAFT 349 THRU 360 WILL ACCOMMODATE
THIS ARRANGEMENT
1. THE SYSTEM IV ADDITIONS ARE NOTED BY [HATCHED BOX]

SYSTEM IV ARRANGEMENT

FIGURE 7



NOTE -
 AIRCRAFT 349 THRU 360 WILL ACCOMMODATE THIS
 ARRANGEMENT
 1. THE APQ 56 ADDITIONS ARE NOTED BY 
 2. PART OF A1 CAMERA EQUIPMENT CAN BE USED
 CONCURRENTLY.

APQ 56 ARRANGEMENT.

LOCKHEED AIRCRAFT CORPORATION

CALIFORNIA DIVISION

REPORT**2. Charting Cameras**

- A. Prototype and production Unit 1 have been installed and flown in the A2 hatch.

3. A1 Cameras

- A. One set was fitted and flown in A/C 342 and 343. Fit of cameras to aircraft and lower hatch satisfactory.
- B. Drive on prototype rocking 24" camera appeared unsatisfactory, but second unit has been modified.
- C. 6" Tri-met installation satisfactory.

4. A2 Cameras

- A. One set fitted and flown in A/C 342. Fit and operation has been satisfactory.
- B. The vacuum system originally provided for camera operation had too little capacity and was modified to correct this.

5. B Camera

- A. Has not made scheduled date of 11-20-55; will probably be ready for test in January.
- B. One hatch is ready, but fabrication has stopped because of optics change which may force a hatch redesign.

6. C Camera

- A. No design work on our part, as this camera is in a state of flux. The prototype delivery schedule now appears to be about 6-1-56.

LOCKHEED AIRCRAFT CORPORATION
CALIFORNIA DIVISION**REPORT****7. System I, S & X Band Receivers**

- A. Installed in A/C 341 and 343; operation has been satisfactory on S band.
- B. X band is presently being flight tested in a T-33.

8. System II - Communication & Navigation

- A. Scheduled for 3-1-56 prototype delivery.
- B. We have determined the location and sizes of the cockpit controls and display for this equipment. The location and sizes of the other components has been difficult to determine because of prior commitments in the equipment bay. We are presently tailoring these components to fit between the duct and the skin in an area which at this time is comparatively open. Space mockups have been made of the available area in the equipment bay which can be used if desired. This is an unsettled problem but is being worked out.

9. System III - VHF Receiver

- A. Scheduled for 3-15-56 delivery.
- B. Nose modifications necessary to install this system have been released to the shop and will appear first on A/C 349.
- C. A prototype flight test is anticipated for a T-33, to start during December. We will mount the receiver on the armament hood door and use an external antenna. Instrumentation to be provided by RW.

LOCKHEED AIRCRAFT CORPORATION
 CALIFORNIA DIVISION
REPORT**10. System IV - Radar Receivers**

- A. Scheduled for 9-1-56 delivery. No data here.
- B. System should be arranged so that only aircraft modification would be a new lower hatch and installation of cockpit controls.

11. APQ56

- A. Scheduled for 4-1-56, this is the light weight system - 520# total.
- B. Structural modifications necessary to incorporate this system have been released to the shop and will first appear on aircraft 349. The radome has been released and is being fabricated.

Flight Test Data Affecting Equipment

- 1. Equipment bay temperatures have been unsatisfactory. A new cockpit heating system installed in aircraft 344 is expected to provide a better controlled and more even temperature to the air entering the bay.
- 2. The original vacuum system provided for camera operation did not have enough capacity. This system has been rectified by providing four separate systems, one for each camera. This method has not yet been flight tested.
- 3. Aircraft pitch, roll and yaw rates and frequencies measured on aircraft 341 and found satisfactory for camera operation. Better rate instrumentation is being provided by H. and will be installed in aircraft 344 for further checking in conjunction with the autopilot.

